

EXHIBIT A

Gkatzimas Report

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**IN THE UNITED STATES BANKRUPTCY COURT
FOR THE DISTRICT OF DELAWARE**

In re:)	
)	
FTX TRADING LTD., et al.,)	Chapter 11
)	
Debtors)	Case No. 22-11068 (JTD)
)	
)	(Jointly Administered)
)	Re: Docket No. 5202

DECLARATION OF
IOANNIS GKATZIMAS

ON BEHALF OF
TMSI SEZC Ltd.



FEBRUARY 16, 2024

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I. QUALIFICATIONS

1. My name is Ioannis Gkatzimas. I am a Principal at the San Francisco office of The Brattle Group (“Brattle”) and the co-leader of Brattle’s Cryptocurrency & Digital Assets practice. The Brattle Group is a global consulting firm that answers complex economic, finance, and regulatory questions for corporations, law firms, and governments around the world. My professional experience often involves analysis of trading activity and addressing valuation questions related to digital assets and their derivatives. I have consulted in several matters involving market structure and trading in global cryptocurrency markets and features of cryptocurrency spot and derivative exchanges (both regulated and unregulated), including product attributes, economic leverage and trading volume. I have also applied valuation methodologies in a variety of contexts, from valuing venture-funded firms in various development stages or firms going through a change of control or liquidation event, to valuing securities and derivatives including in illiquid markets.
2. As part of my consulting experience, I led and performed economic analyses in a wide range of disputes related to derivatives (both exchange-traded and over-the-counter), including futures, swaps, and options, and their market applications. In particular, I have consulted on matters involving the features and product design of perpetual futures, including their similarity with standardized futures, their margin requirements, potential payoff structures and other valuation issues. I have also provided opinions and testimony on the value of a cryptocurrency derivatives exchange where I explained the economic characteristics of futures contracts and their typical use cases, and I analyzed relevant market activity like trading volume.
3. I have consulted in several other matters related to the cryptocurrency industry. Examples include consulting on a dispute over a liquidation strategy and potential market impact of a concentrated position in a digital asset, providing analyses of market structure and use cases of stablecoins, providing arbitrage analyses of observed flows by market participants and volumes across cryptocurrency exchanges, examining product design and features of derivatives offered in unregulated cryptocurrency exchanges, and providing analyses of volume and economic activity underlying spot cryptocurrency markets used to inform settlement prices on regulated cryptocurrency derivative products (including representations to regulators and investors).

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4. I have also been a member of the professional faculty at UC Berkeley's Haas School of Business since 2013, during which I designed and taught a course in Financial Engineering and, more recently, a course in Investments for undergraduates. As part of these courses, I have been teaching the various methodologies used to value derivatives (including futures, options, and swaps). In particular, I have taught the use of liquid futures markets to speculate or to hedge against risk in financial markets, commodities, and cryptocurrencies, and the use of margin and posting of collateral in futures trading. My courses address the structure of derivative markets, the economics of derivative trading, and the risk management and hedging tools for derivative positions.
5. I earned a M.Sc. in Financial Mathematics from Stanford University, a Master of Financial Engineering from the UC Berkeley's Haas School of Business, and an MBA in International Finance from St. John's University. Prior to my studies, I served as an officer-in-reserve for the Hellenic Armed Forces and earned my undergraduate degree in Pharmaceutical Sciences at the Aristotle University of Thessaloniki in Greece. I also hold the Chartered Financial Analyst® designation ("CFA") and I have been a member of the CFA Society of San Francisco since 2010. A copy of my curriculum vitae is provided in Appendix A.
6. Brattle is compensated at my hourly billing rate of \$800 for my work on this matter. In this report, I have been supported by Brattle's consulting staff who worked under my guidance. Our compensation is not contingent on the outcome of this matter. I have formed my opinions based on the material I reviewed, and I reserve the right to update my opinion if I receive additional material and information about this matter.

II. ASSIGNMENT AND SUMMARY OF OPINIONS

7. I have been asked by counsel for TMSI SEZC Ltd. ("TMSI") to review the calculations in the declaration of Professor Sabrina T. Howell ("Howell Declaration") and to estimate the claims by FTX's customers, based on the crypto token SRM as of the Petition Time (10:00 am ET on November 11, 2022).
8. The Howell Declaration provides a value in U.S. dollars as of the Petition Time for claims based on digital assets by FTX customers. In the context of certain crypto tokens, including SRM, the

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Howell Declaration assumes that (i) the Debtors' holdings of those tokens would need to be liquidated to satisfy customers' claims, and that (ii) in an orderly liquidation commencing as of the Petition Time, the sale of Debtors' holdings would have likely impacted the market price for certain tokens, and therefore, an "asset liquidation discount" needs to be applied to the market price of these tokens as of the Petition Time. The Howell Declaration estimates that the asset liquidation discount in the context of the SRM tokens is 58.32%.

9. I estimate the asset liquidation discount in the context of the SRM tokens to be 12.47%. My result differs to that of the Howell Declaration for two key reasons:
 - a. Use the Customers' Claims: First, the Howell Declaration estimates the asset liquidation discount to be applied to the customers' claims based on liquidating all of Debtors' holdings, as opposed to the holdings associated with FTX customer claims, including those of TMSI. I understand that there is a legal dispute regarding whether it is appropriate to consider the liquidation of Debtor's SRM holdings at all in determining the SRM price as of the Petition Date. I do not opine on that question, and have been instructed to provide estimates under both scenarios. Using the methodologies in the Howell Declaration, without any adjustments (other than data sources), I estimate the asset liquidation discount associated with FTX customer claims based on the SRM tokens to be approximately 20%. This estimate corresponds to a scenario where the Debtors sell only tokens attributable to customer claims.
 - b. Include the Perpetual Futures Market: Second, in estimating the trading activity in the SRM tokens, the Howell Declaration ignores a significant source of liquidity in the market. Specifically, the Howell Declaration only takes into account the trading volume in the spot markets, and disregards the trading volume in the perpetual futures markets. The perpetual futures markets for many crypto assets, including SRM, were relatively active (and often more active than the spot markets in the case of SRM) in the one-year period leading up to the Petition Time, and therefore serve as an important avenue of liquidity for market participants. By ignoring volume from the perpetual futures markets, the Howell Declaration underestimates the trading activity in the SRM tokens, and as a result, overestimates the asset liquidation discount. Once the trading volume in the perpetual futures markets has been included in the volume input in the KO Model, the asset liquidation discount for SRM (based

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on the number of tokens associated with FTX customer claims as opposed to the Debtors' holdings) is estimated to be as low as 12.47%.

III. BACKGROUND

A. THE MARKETS IN WHICH SRM IS TRADED

10. Serum is a decentralized cryptocurrency exchange (“DEX”) that was built on the Solana blockchain and launched in August 2020.¹ It was supported by the Serum Foundation and backed by FTX, Alameda Research, and the Solana Foundation, among others.² SRM was the utility and governance token of the Serum ecosystem.³
11. Prior to the bankruptcy of FTX, SRM spot and SRM perpetual futures were actively traded on a number of platforms, such as Binance, Bybit, and Okcoin. As shown in Figure 1, the daily volume in SRM spot markets over the period from November 2, 2021 to November 1, 2022 (the estimation period set forth in the Howell Declaration) ranges from more than 5 million to almost 200 million tokens. The daily volume in SRM perpetual futures over the same period is generally higher than that in the spot markets, ranging from less than 5 million to more than 600 million tokens.

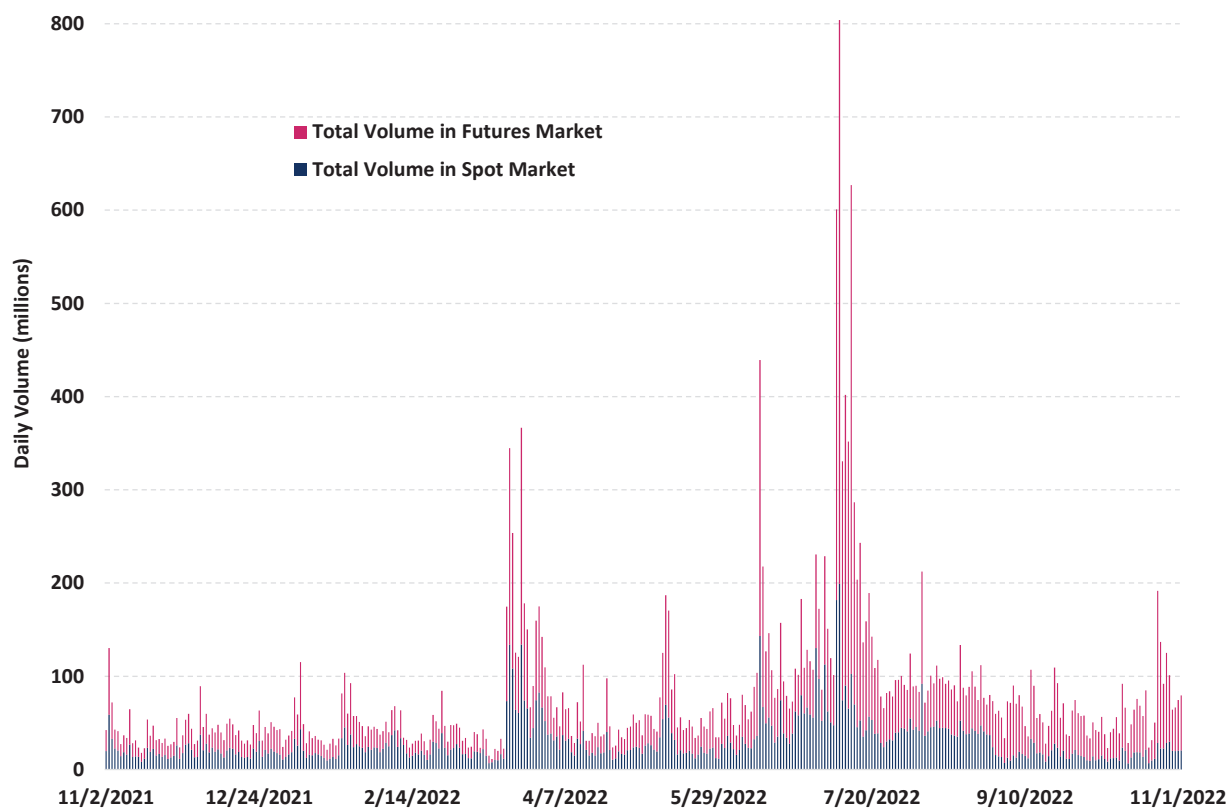
¹ Project Serum Overview, (“Serum launched on the 31st of August 2020 and was one of the first major open source projects to build on Solana.”). Available at: <https://docs.projectserum.com/introduction/overview>.

² Project Serum Overview, (“It is supported by the Serum Foundation, and backed by a consortium of experts in cryptocurrency trading and decentralized finance, including FTX, Alameda Research, and the Solana Foundation.”). Available at: <https://docs.projectserum.com/introduction/overview>.

³ Project Serum Overview, (“SRM is the utility and governance token of the Serum ecosystem”). Available at: <https://docs.projectserum.com/introduction/overview>.

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**FIGURE 1: SRM DAILY VOLUME IN THE SPOT AND PERPETUAL FUTURES MARKETS
NOVEMBER 2, 2021 – NOVEMBER 1, 2022**



Sources: Data from CoinAPI; srm_volumes_derivative.csv and srm_volumes_spot.csv from TMSI. Data for Okcoin, Serum, Gate.io, AscendEX, and MESC exchanges from TMSI.

12. Figure 2 summarizes the average daily volume in SRM spot and perpetual futures markets over the same period shown in Figure 1, again showing that the futures markets in SRM were more active than the spot markets in this period. I discuss the concept of perpetual futures in the next section.

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**FIGURE 2: AVERAGE DAILY VOLUMES FOR SPOT AND FUTURES MARKETS
NOVEMBER 2, 2021 – NOVEMBER 1, 2022**

Average Daily Volume	
Spot Market	30,187,655
Futures Market	47,533,298

Sources: Data from CoinAPI; srm_volumes_derivative.csv and srm_volumes_spot.csv from TMSI. Data for Okcoin, Serum, Gate.io, AscendEX, and MESC exchanges from TMSI.

B. PERPETUAL FUTURES MARKETS

13. Perpetual futures contracts are actively traded instruments in the crypto market. A futures contract, in general, is an agreement between two parties to buy or sell an asset at a predetermined time in the future (typically referred to as “expiration date”) for a predetermined price. Futures contracts allow market participants to either (i) gain exposure to an underlying asset without having to own the asset, or (ii) lock-in (or hedge) the value of an asset today without having to sell the underlying asset. Further, futures contracts can provide “leverage”, which allows investors to gain economic exposure to an underlying asset by putting up an initial amount that is less than the total value of the intended exposure. Perpetual futures contracts are similar to standard futures contracts except for one key difference, which is that perpetual futures contracts do not have an expiration date.⁴
14. Given the popularity of perpetual futures contracts in crypto markets, the perpetual futures markets are an important avenue of liquidity for market participants trading in crypto assets such as SRM tokens. For example, suppose a market participant wants to gain exposure to SRM tokens for potential upside benefit (while also bearing potential downside risk). The market participant can either (i) buy SRM tokens in the spot markets, or (ii) buy perpetual futures

⁴ There are additional technical differences about funding rates, collateral posting and liquidation policies that may vary from provider to provider. Traditional equity markets futures are generally tied to broader indices whereas perpetual futures in crypto markets can use individual tokens as reference assets. Note that perpetual futures contracts are currently not available in the U.S. markets. *See*, for example, “Kraken Futures eligibility,” Kraken Support, accessed February 16, 2024 at <https://support.kraken.com/hc/en-us/articles/360023786632-Kraken-Futures-eligibility> and “Perpetual futures introduction,” Coinbase Help, accessed February 16, 2024 at <https://help.coinbase.com/en/coinbase/trading-and-funding/derivatives/pf-intro>.

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contracts referencing SRM. Alternatively, if a market participant that already owns SRM tokens wants to exit their exposure, they can either (i) sell their SRM token holdings in the spot markets, and/or (ii) sell perpetual futures contracts referencing SRM. In the second scenario, the market participant can effectively hedge their position using perpetual futures contracts to avoid any future exposure to price fluctuations in the value of SRM.⁵

15. Since perpetual futures contracts do not have an expiration date, exchanges implement an anchoring mechanism called the funding rate to help keep the perpetual futures price in line with the underlying asset's price. The funding rate mechanism requires either the long (i.e., buyer) or short (i.e., seller) side of the perpetual futures contract to pay a fee or receive a rebate, depending on whether the futures price is below or above the spot price. Such fees/rebates would in turn affect the demand or supply of perpetual futures contracts, helping to anchor the futures price to the spot price.⁶

C. EVENTS LEADING UP TO THE FTX BANKRUPTCY AND IMPACT ON SRM

16. Calendar year 2022, dubbed “crypto winter” by many, was a year of distress for the crypto industry. One of the biggest and most impactful events was the bankruptcy of FTX in November 2022. The downfall of FTX happened abruptly, with the first significant public warning sign on November 2, 2022, which was then followed by a string of revelations that culminated in the

⁵ For example, a market participant who owns SRM tokens and wants to lock-in the current value could sell perpetual futures contracts referencing SRM. During the period where the futures position remains open, the market participant is protected by unexpected price moves in the SRM tokens and has secured the economic value of the tokens as of the futures trade date. If the spot market price for SRM declines, the market participant will offset this decline through a related gain (or accumulated gains) in the short futures position. If the spot market price for SRM increases, the market participant will forego this gain through related loss (or accumulated losses) in the short futures position. By using futures, a market participant can access another market and hedge their economic exposure to future price moves of the SRM tokens, effectively locking in the price of the tokens today. I note that the size of the futures transaction (i.e., the exact number of futures contracts traded) is a choice made by the market participant once they consider market conditions, and the customary costs of trading in the futures markets, such as the funding rate discussed in paragraph 15.

⁶ See, for example, Binance, “Introduction to Binance Futures Funding Rates”, November 08, 2019, accessed February 15 2024 at <https://www.binance.com/en/support/faq/introduction-to-binance-futures-funding-rates-360033525031>.

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FTX bankruptcy filing on November 11, 2022. The sequence of events has been well documented and occurred as follows:

- a. **November 2:** An article was published on CoinDesk reporting that “Alameda [FTX’s sister company] rests on a foundation largely made up of a coin that [FTX] invented.” Specifically, the article revealed that of Alameda’s \$14.6 billion in assets, nearly \$6 billion was in FTT, a crypto token created specifically for FTX.⁷
- b. **November 6:** Binance CEO Changpeng Zhao publicly announced that Binance would eliminate all FTT from its balance sheet. Binance had a substantial holding of FTT tokens from when it sold its equity to FTX in 2021. Mr. Zhao stated that, “Due to recent revelations that have come [sic] to light, we have decided to liquidate any remaining FTT on our books.”⁸
- c. **November 8:** FTX halted customer withdrawals after customers had withdrawn \$6 billion from the platform in the previous 72 hours. Mr. Zhao revealed that FTX asked for assistance from Binance to cover its “liquidity crunch.” Binance signed a non-binding letter of intent to acquire FTX. The FTT token price dropped precipitously, falling from an opening price of \$17 to a close of \$4.23.⁹
- d. **November 9:** Binance walked away from a deal to rescue FTX, saying, “As a result of corporate due diligence, as well as the latest news reports regarding mishandled customer funds and alleged US agency investigations, we have decided that we will not pursue the potential acquisition of FTX.com.”¹⁰

⁷ Ian Allison, “Divisions in Sam Bankman-Fried’s Crypto Empire Blur on His Trading Titan Alameda’s Balance Sheet,” *CoinDesk*, November 2, 2022, accessed February 15, 2024 at <https://www.coindesk.com/business/2022/11/02/divisions-in-sam-bankman-frieds-crypto-empire-blur-on-his-trading-titan-alamedas-balance-sheet/>.

⁸ James Cirrone and Katherine Ross, “FTX began to unravel one year ago today: A timeline,” *Blockworks*, November 6, 2023, accessed February 13, 2024 at <https://blockworks.co/news/ftx-meltdown-timeline>.

⁹ James Cirrone and Katherine Ross, “FTX began to unravel one year ago today: A timeline,” *Blockworks*, November 6, 2023, accessed February 13, 2024 at <https://blockworks.co/news/ftx-meltdown-timeline>.

¹⁰ Binance Twitter feed, “As a result of corporate due diligence, as well as the latest news reports regarding mishandled customer funds and alleged US agency investigations, we have decided that we will not pursue the potential acquisition of FTX.com,” November 9, 2022. Available at: <https://twitter.com/binance/status/1590449161069268992?s=20>.

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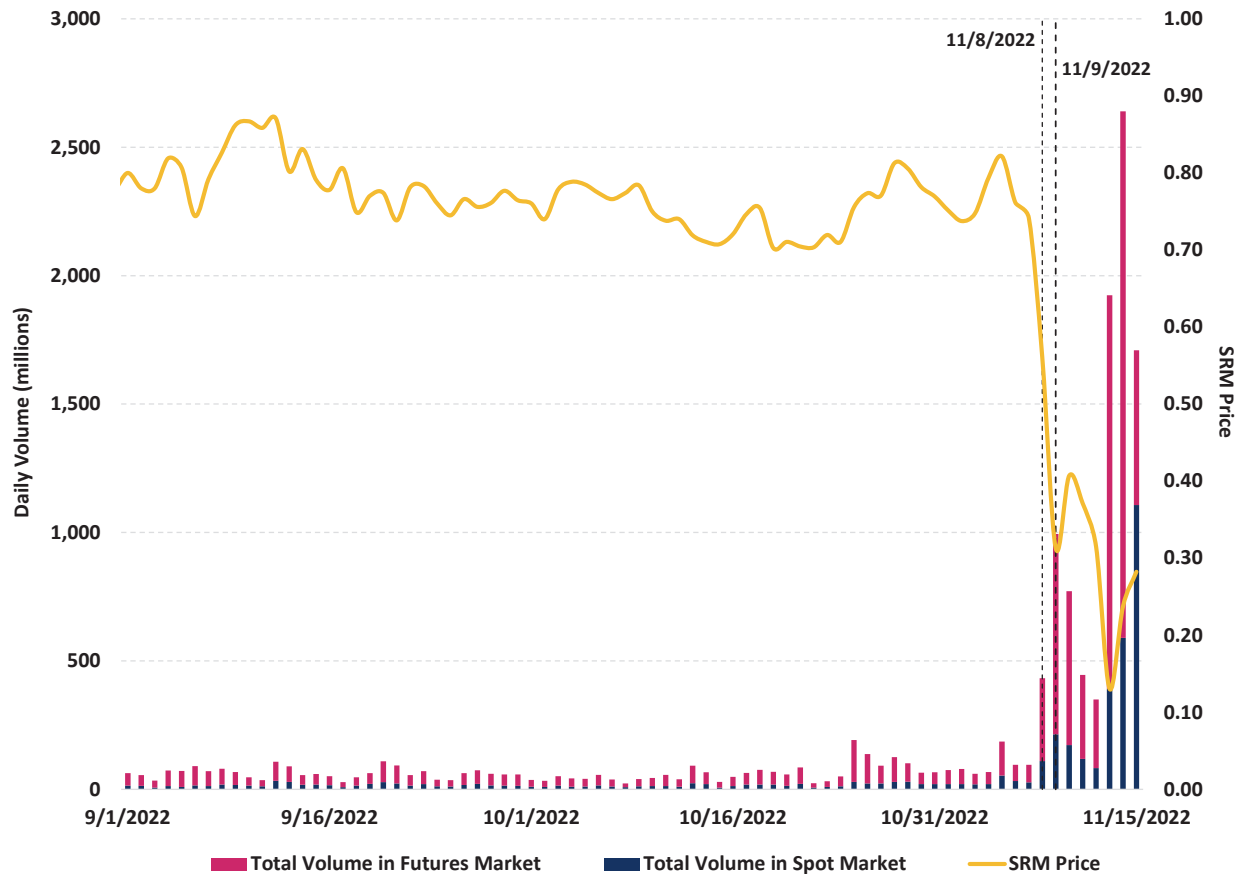
- e. **November 10:** The Wall Street Journal reports that FTX lent billions of dollars in customer assets to fund bets by Alameda Research.¹¹
 - f. **November 11:** FTX files for chapter 11 bankruptcy protection.¹²
17. While FTX was facing questions of survival from November 2, 2022 through November 11, 2022, so too was the SRM token in tandem with FTX's distress. Serum was technically governed as a decentralized autonomous organization ("DAO"), although FTX held the private keys required to make changes to the Serum code.¹³ When FTX halted customer withdrawals on November 8, 2022, the price of SRM dropped by 24% from a price of \$0.742 at 12:00 am UTC to \$0.560 over a period of approximately 24 hours. And on the next day, November 9, 2022, when Binance pulled out of its potential deal to save FTX, SRM dropped another 44% to \$0.313 by 11:59 pm UTC. This is illustrated in Figure 3, which depicts SRM's relatively stable price form September 1, 2022 until the FTX collapse started to unfold.

¹¹ Candice Choi, "Crypto Crisis: A Timeline of Key Events," *The Wall Street Journal*, June 6, 2023, accessed February 13, 2024 at <https://www.wsj.com/articles/crypto-crisis-a-timeline-of-key-events-11675519887>.

¹² Candice Choi, "Crypto Crisis: A Timeline of Key Events," *The Wall Street Journal*, June 6, 2023, accessed February 13, 2024 at <https://www.wsj.com/articles/crypto-crisis-a-timeline-of-key-events-11675519887>.

¹³ Joel Khalili, "The Race to Save Sam Bankman-Fried's Other Crypto Exchange," *Wired*, November 22, 2022, accessed February 16, 2024 at <https://www.wired.com/story/ftx-serum-crypto-exchange/>.

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**FIGURE 3: SRM PRICE AND VOLUME
SEPTEMBER 1, 2022 – NOVEMBER 15, 2022**

Sources: Data from CoinAPI; srm_volumes_derivative.csv and srm_volumes_spot.csv from TMSI. Data for Okcoin, Serum, Gate.io, AscendEX, and MESC exchanges from TMSI.

D. THE KYLE AND OBIZHAEVA MODEL (THE “KO MODEL”)

18. The Howell Declaration provides a value in U.S. dollars as of the Petition Time (10:00 am ET on November 11, 2022) for claims based on digital assets by FTX customers.¹⁴ In the context of certain crypto tokens, including SRM, the Howell Declaration assumes that (i) the liquidation of the Debtors’ holdings of those tokens would be needed to estimate the value of the the customers’ claims, and that (ii) in an orderly liquidation commencing as of the Petition Time, the sale of Debtors’ holdings would have likely impacted the market price for certain tokens, and

¹⁴ Howell Declaration, ¶ 3.

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therefore, an “asset liquidation discount” needs to be applied to the market price of these tokens as of the Petition Time.¹⁵

19. To estimate the asset liquidation discount, the Howell Declaration applies a model from the market microstructure literature, the KO Model. As explained in the Howell Declaration, the KO Model allows for calculations of an estimated asset liquidation discount on holdings of a certain size with relatively few inputs. The asset liquidation discount is the sum of two components of transaction costs, the bid-ask spread and the price impact, with the price impact generally accounting for the majority of the total transaction costs. The main four inputs to the KO Model are:
 - a. The size of the volume to be liquidated: All else equal, a larger liquidation volume will result in a larger price impact and thus, a larger liquidation discount.
 - b. The average daily trading volume in the asset over an estimation period (i.e., a period before the estimation date):¹⁶ More liquid assets generally have higher trading volume than less liquid assets. Liquidation of a certain size in more liquid assets (i.e., assets with higher trading volume), all else equal, will result in a smaller price impact compared to liquidation of the same holdings size in less liquid assets.
 - c. The volatility of the underlying asset: This input can be estimated as the standard deviation of daily returns during the estimation period. Directionally, the higher the volatility, all else equal, the larger the price impact associated with the liquidation of a certain holdings size.
 - d. The price of the asset as of the Petition Time: All else equal, the price of the asset affects only the bid-ask spread cost component, and does not have significant contribution to the overall liquidation discount for sizable holdings.
20. The authors of the KO Model note that the predictions of their model are consistent with empirical estimates derived from transactions in the U.S. equities markets. They then “conjecture that predictions of [the model] may generalize to other markets such as bond markets, currency

¹⁵ Howell Declaration, ¶ 46.

¹⁶ The estimation period employed in the Howell Declaration is the one year-window from November 2, 2021 to November 1, 2022. Howell Declaration, Appendix C, ¶18.

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markets, and futures markets, as well as to other countries”, adding “[w]hether market microstructure invariance applies to other markets poses an interesting set of issues for future research.”¹⁷ The Howell Declaration opines that the KO Model is “likely applicable to digital asset markets”.¹⁸ However, as I discuss in the next section, the implementation of the KO Model in the Howell Declaration overlooks a significant source of liquidity in the context of the SRM tokens. Thus, the implementation of the KO Model in the Howell Declaration results in an overestimation of the overall liquidation discount for the SRM tokens at issue.

IV. THE APPLICATION OF THE KO MODEL IN THE HOWELL DECLARATION DOES NOT PROPERLY ACCOUNT FOR TRADING VOLUME IN THE SRM TOKENS

21. In this section, I discuss the key flaw in the Howell Declaration’s implementation of the KO Model in the context of the SRM tokens. Specifically, by ignoring the relatively sizeable liquidity in SRM perpetual futures, the Howell Declaration accounts for less than half of the SRM token liquidity (i.e., trading volume) that was accessible to market participants during the estimation period. This failure to account for the aggregated available trading volume related to SRM tokens across markets results in an overestimation of the asset liquidation discount associated with the claims based on these tokens.
22. A key input to the KO Model is the size of the liquidation amount relative to the liquidity in the asset as estimated by the average daily trading volume in the estimation period. The average daily trading volume represents the typical trading activity in the asset on a given day, where some investors execute purchase orders to gain exposure to an asset and others execute sell orders to reduce their economic exposure. As I discussed above, all else equal, for a given liquidation amount, the price impact as implied by the KO Model is smaller in markets that are more active (i.e., with higher daily trading volume). An underestimation of the daily trading volume input thus will result in an overestimation of price impact, as was the case here for SRM.

¹⁷ Albert S. Kyle and Anna A. Obizhaeva, 2016, “Market microstructure invariance: empirical hypotheses”, *Econometrica* 84(4), pp. 1345 – 1404, p. 1401. <https://www.jstor.org/stable/43866470>.

¹⁸ Howell Declaration, ¶ 69.

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23. The Howell Declaration states that the liquidation discount was estimated assuming an “orderly liquidation” at the Petition Time.¹⁹ A sophisticated market participant, in the context of an orderly liquidation of a large holding, would likely need to consider a trading strategy that can make use of all accessible markets/trading venues so as to maximize the liquidation proceeds (and minimize the price impact of the liquidation) over a reasonable period of time. As I explained above in section III.B, for a market participant that already owns SRM tokens to exit their exposure, they can either (i) sell their SRM token holdings in the spot markets, and/or (ii) sell futures contracts referencing SRM.²⁰ Both the spot markets and the perpetual futures markets for SRM tokens were active in the one-year period before the Petition Date, with the perpetual futures markets being a significant avenue of liquidity for market participants trading in SRM.²¹ This means market participants were looking to gain long exposure (i.e., buy) or bet against (i.e., sell) SRM tokens in both markets. A sophisticated market participant that wants to sell or exit their exposure to a large holding would make use of all markets with potential buyers, including perpetual futures markets. Sophisticated market participants transacting in SRM would be well aware of the existence of both the spot and perpetual futures markets, as SRM and its perpetual future were listed and active across several exchanges, including Binance, Bybit, and Okcoin.
24. For example, suppose a market participant wanted to exit a sizeable holding of SRM tokens. The market participant could sell the entire holdings on the spot markets, which, on average during the estimation period, facilitates trading volume of 30 million SRM tokens a day (see Figure 2). Alternatively, the market participant could sell a portion of the SRM token holding on the spot markets, and sell perpetual futures contracts to lock in (or hedge) the value of the remaining SRM tokens. Collectively, the spot markets and the perpetual futures markets, on average during the estimation period, facilitate trading volume of almost 78 million tokens a day (see Figure 2). This means the two markets collectively were able to offer more than twice the liquidity that the spot markets could offer to a market participant seeking to offload a large exposure on a given

¹⁹ Howell Declaration, ¶ 4.

²⁰ In the context of Bitcoin, a recent academic study shows that the introduction of futures was beneficial to the spot market, enhancing market quality and price informativeness in the spot market. See Patrick Augustin, Alexey Rubtsov, and Donghwa Shin, 2023, “The impact of derivatives on spot markets: Evidence from the introduction of bitcoin futures contracts.” *Management Science* 69(11), 6752-6776.

²¹ In addition, trading can also occur on the blockchain, which is not necessarily reflected in exchange data.

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day. If the price of SRM tokens falls over a future period of time, the value of the token holdings will decline, but such a decline will be almost exactly offset by the gains in their futures position.²² In other words, the market participant is no longer exposed to price fluctuation in the SRM tokens, effectively locking in a price at the time of entering into the perpetual futures contracts.

25. The Howell Declaration, in estimating the trading volume in SRM, only takes into account trading activity on the spot markets.²³ This is a fundamental flaw. By limiting its analysis to just the spot markets, the Howell Declaration disregards a significant source of liquidity, and as a result, substantially overestimates the asset liquidation discount associated with the claims based on the SRM tokens. I estimate the asset liquidation discount taking into account the trading activity in SRM in both the spot markets and the futures markets in section V.

V. THE ASSET LIQUIDATION DISCOUNT ASSOCIATED WITH CUSTOMERS' CLAIMS BASED ON HOLDINGS OF SRM TOKENS

26. I have been asked to estimate the liquidation discount associated with claims by FTX customers based on the SRM tokens. I understand from the Howell Declaration that the face value of these claims as of the Petition Date is \$509.6 million. Given the price of SRM tokens as of the Petition Date of \$0.37, a face value of \$509.6 million equates to approximately 1.37 billion tokens. In this section, I first follow the steps outlined in the Howell Declaration to estimate the asset liquidation discount associated with this quantity. I do this to calculate the asset liquidation discount that would be arrived at if the methodology set forth in the Howell Declaration were used with my data sources. I then correct the volume calculation in the Howell Declaration (discussed in section IV above). My final estimate of the liquidation discount associated with the claims by FTX customers based on the SRM tokens is approximately 12.47%.

²² As I discussed in paragraph 15, the market design of perpetual futures keeps them closely tied to the price of SRM tokens in the spot markets. In addition, market participants who can trade on both the spot and the futures markets further enforce this mechanism by eliminating discrepancies through arbitrage trading.

²³ Howell Declaration, Appendix C, p. C-4, footnote 11.

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Replicating the methodology in the Howell Declaration

27. My estimate of the asset liquidation discount associated with the claims by FTX customers based on the SRM tokens, using the framework in the Howell Declaration, is shown in Figure 4 below. In deriving this estimate, I follow the steps outlined in the Howell Declaration, specifically:
- I use the period from November 2, 2021 to November 1, 2022 as the estimation period.
 - I use the Howell Declaration's selection of close prices of adjacent days to estimate daily returns.
 - I calculate daily volatility as the standard deviation of daily returns (after demeaning).
 - I calculate the average daily volume as the average of the daily volume in SRM tokens on the spot markets during the estimation period.
 - I estimate the asset liquidation discount using Equation 2 in Appendix C of the Howell Declaration.

FIGURE 4: REPLICATION OF THE HOWELL DECLARATION

		Customers' Claims	Debtors' Holdings
Asset Liquidation Discount	[1]	19.99%	53.75%

Sources and Notes:

Data from CoinAPI; srm_volumes_derivative.csv and srm_volumes_spot.csv from TMSI. Data for Okcoin, Serum, Gate.io, AscendEX, and MESC exchanges from TMSI.

28. As noted, while I follow the steps outlined in the Howell Declaration, I do not have access to CoinMetrics data, and instead, I use data from CoinAPI, another leading crypto data provider, and data provided by TMSI. For comparison, using CoinMetrics data, the asset liquidation discount associated with the Debtors' holdings of \$3.7 billion set forth in the Howell Declaration is 58.32%.²⁴

²⁴ Howell Declaration, Exhibit 3. The Howell Declaration excludes data from three exchanges, including LBank, ZB.com, LocalBitcoins. Only ZB.com appears in my CoinAPI data, which I also exclude to be consistent with the methodology in the Howell Declaration. I note that I received the underlying input values used in the Howell Declaration for the calculation of the asset liquidation discount associated with the SRM tokens on February 15, 2024. The key difference between our analyses is the average daily trading volume input. The average daily trading volume estimated for the Howell Declaration is 25.2 million tokens (see

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Adjusting for the trading volume calculation in the Howell Declaration

29. The estimates in Figure 4 only rely on the average daily volume in SRM tokens on the spot markets. To account for the significant trading activity in the perpetual futures markets for SRM tokens, I re-estimate the asset liquidation discounts in Figure 4 taking into account daily volume in both the spot markets and the perpetual futures markets. Specifically, for each trading day during the estimation period, I calculate trading volume in SRM tokens as the sum of spot market volume and futures volume. I then estimate the average trading volume as the average of the aggregate daily volume in SRM tokens (across both the spot markets and the perpetual futures markets) during the estimation period. The results from this calculation are shown in Figure 5. Figure 5 illustrates that the Howell Declaration overestimates the asset liquidation discounts by failing to consider liquidity across all accessible markets. By adjusting the volume calculation in the Howell Declaration to include both the spot markets and the perpetual futures markets for SRM tokens, the asset liquidation discount associated with the Debtors' holdings declines from 53.75% to 33.51%. The asset liquidation discount associated with the customers' holdings declines from approximately 20% to 12.47%.

FIGURE 5: ADJUSTING THE TRADING VOLUME IN THE HOWELL DECLARATION

		Customers' Claims	Debtors' Holdings
Asset Liquidation Discount			
- <i>Spot Markets Only (Howell's Methodology)</i>	[1]	19.99%	53.75%
Asset Liquidation Discount			
- <i>Spot + Futures Markets</i>	[2]	12.47%	33.51%

Sources and Notes:

CoinAPI; srm_volumes_derivative.csv and srm_volumes_spot.csv from TMSI. Data for Okcoin, Serum, Gate.io, AscendEX, and MESC exchanges from TMSI.

FTX_DA_EST_000000068.XLSX), compared to my estimate of 30 million tokens. If I were to use the average daily volume of 25.2 million instead, I arrive at an estimate of 58.8%, almost identical to the estimate in the Howell Declaration.

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APPENDIX A: CURRICULUM VITAE OF IOANNIS GKATZIMAS, CFA**PRINCIPAL | SAN FRANCISCO, CA**

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Mr. Gkatzimas specializes in complex financial markets disputes related to trading, valuing, and investing in securities and portfolios across asset classes, including digital assets.

Mr. Gkatzimas is the leader of Brattle's credit, derivatives and structured products practice, and the co-leader of Brattle's cryptocurrency and digital assets practice. He is an expert on derivative securities, structured finance, credit products, alternative investments, and digital assets, including their unique regulatory considerations, market structure, transactions, and valuation practices. Mr. Gkatzimas has significant experience with benchmark-related matters, and he actively consulted on financial industry considerations related to the fallback framework of interbank-offered rates (IBORs). Recent digital asset consulting engagements include analyses of market structure and regulatory issues in the emerging cryptocurrency ecosystem, including cryptocurrency exchanges, the trading of digital assets and their derivatives, and the evolution of initial coin offerings (ICOs).

Clients engage Mr. Gkatzimas in a wide range of finance-related issues. He consults on disputes involving venture capital investments and contingent claims, valuation of illiquid securities, options, warrants, swaps and bespoke derivatives, fixed-income securities, credit instruments, and on securities class actions and mergers and acquisitions. In his expert analysis work, he frequently addresses transaction and valuation disputes involving large, complex datasets.

Mr. Gkatzimas has led experts and consulting teams through all stages of regulatory investigations, litigations, arbitrations, and mediations. His casework spans numerous industries, including banking and financial institutions, mortgage finance, financial services and investment management, pharmaceuticals, technology, and energy. Notable engagements include a series of reports for the International Swaps and Derivatives Association (ISDA) on IBOR fallback rates in derivative markets, the Department of Justice's investigation of S&P rating practices for collateralized debt obligations (CDOs), and the JDS Uniphase Corporation Securities Litigation.

In addition to his consulting work, Mr. Gkatzimas is a member of the professional faculty at the UC Berkeley Haas School of Business, where he developed and taught undergraduate courses on financial engineering and investments. Mr. Gkatzimas is a CFA charterholder (Chartered Financial Analyst) and a member of the CFA San Francisco society.

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A.1 EXPERT WITNESS EXPERIENCE (REPORTS AND TESTIMONY)

- Confidential filing, Delaware Corporation, Plaintiff, v. Group of Investors, Defendants | Declaration filed with the Delaware Court of Chancery (January 5, 2024)
- Hyde Park Venture Partners Fund III, L.P. and Hyde Park Venture Partners Fund III Affiliates, L.P., Petitioners, v. FairXchange, LLC, a Delaware limited liability company, as successor in liability to FairXchange, Inc., a Delaware Corporation, Respondent | Case No. C.A. No. 2022-0344-JTL | Reports (filed June 30, 2023, and August 2, 2023); Deposition (September 13 and September 14, 2023); Expert Testimony at Delaware Court of Chancery Trial (November 15, 2023)
- James Brewer, M.D, Ph.D., v. Impact Biomedicines | Case No. 37-2019-00067876-CU-CO-CTL | Deposition (October 21, 2022); Expert Testimony at Jury Trial (January 26 and January 30, 2023)
- Balaji K. Srinivasan, an individual, Plaintiff, v. Hashflow Foundation Inc., a Delaware Corporation, Defendant | Case No. CGC-22-597585 | Declaration (January 27, 2022)
- Confidential Arbitration, Former Employee v. Start-up Industrial Company | JAMS | Deposition (January 19, 2022); Expert Testimony (February 1, 2022)
- Mizner Court Holdings LLC and San Marco Holdings LLC v. Broken Sound Club Inc. | Case No. 19-CA-16023-MD | Report (filed on August 6, 2021); Deposition (August 27, 2021)
- Confidential Arbitration, Venture-funded Firm v. Investment Bank | AAA | Reports (filed November 23, 2020, and January 29, 2021); Expert Testimony (including hot-tubing) (February 5, 2021)
- DIONYSOS G.P.R.C.S. v. Ieronymakis | Report (filed June 22, 2015)
- DIONYSOS G.P.R.C.S. v. Finos Film | Report (filed May 15, 2015)

A.2 SELECTED CONSULTING EXPERIENCE

Derivative Securities and Credit Instruments

- Consulted on litigation involving a CFTC-registered commodity pool operator specializing in listed options on futures. Directed analyses regarding general risk profile of the fund and degree of deviation from past historical periods, and analyses regarding communications with its investors.
- Led the preparation of a Brattle report for ISDA summarizing the results of surveying market participants on the clearing of US treasury securities and repurchase agreements. Report is published on ISDA's website [here](#).

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- Consulted with ISDA and its counsel to analyze and summarize market participant responses to ISDA consultations on fallbacks for derivatives referencing IBORs. Consulted on operational and valuation issues raised by market participant respondents (including convexity adjustments) related to interest rate swaps, swaptions, and other derivatives of fixed income products that may result from a replacement of IBOR benchmark rates with fallback rates. Brattle's series of reports are published on ISDA's website and also available [here](#).
- Analyzed option-based portfolio strategies and volatility trading strategies, including risk management processes and oversight. Evaluated trading signals on option strategies and probability of profitable outcomes. Consulted on matters involving the suitability of investments in contingent-claim securities (like options and warrants) in investor portfolios.
- Provided expert opinion and testimony on the applicability and limitations of option valuation approaches to model real-estate assets. Assessed and critiqued the reasonableness of damages estimates.
- Assessed the economic value of equity and warrants of partners in a privately held entity and performed sensitivity analyses of such economic value with respect to volatility and cost of capital, among other parameters.
- Reviewed valuation of interest rate swaps and other interest rate derivatives in benchmark rates (LIBOR) litigation, including off-market pricing. Assessed the valuation of interest rate swaps, including the reasonableness of input assumptions based on Bloomberg analytics.
- Consulted on the implementation of an option strategy to minimize downside risk in equity portfolios. Analyzed the structure of a "collar" strategy overlaid on active and passive equity portfolios, and the hedging cost of such an approach in volatile market conditions. Estimated potential damages to investors.
- Consulted on a matter involving the valuation of bespoke equity swaps and exotic options and analyzed the economic substance of a large structured transaction. Used Monte Carlo simulation techniques to estimate the probabilities of profitable outcomes.
- Analyzed the market structure and bid-ask spreads of a portfolio of credit default swap contracts. Assessed the reasonableness and the calculation of settlement amounts and considerations of collateral upon a counterparty default under an ISDA Master Agreement. Examined aggregate mark-to-market valuation adjustments for a large credit derivatives portfolio that included bespoke illiquid credit instruments and index products.
- Consulted on the valuation of warrants embedded in special purpose acquisition company (SPAC) transactions. Analysis included analyses of disclosures to investors, dilution impact, and relative pricing against the underlying common stock of SPAC entities.

Venture Capital and Private Equity

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- Provided expert opinion and testimony on the valuation of warrants granted by a venture-funded firm to an investment bank as consideration of capital raising efforts involving preferred stock and convertible notes. Analyzed and quantified the number and value of warrants adjusting for anti-dilution provisions based on the investment banking agreement and private placement memoranda. Employed simulation techniques to value warrants under various scenarios.
- Provided expert analyses and testimony on the valuation of employee stock options in a high-growth industrial company. Analyses included review of market liquidity, and price and volume of the underlying security, including its exchange-traded options, tax considerations, vesting windows, and optimal time to exercise.
- Provided expert opinion and testimony on the economic applicability of option valuation models in a real estate dispute. Analyzed relevant valuation parameters and rebutted economic damages theories.
- Retained to assess the value of an equity incentive plan components during a sequence of corporate actions involving a start-up. Analyzed the impact of such corporate actions on voting rights and assessed whether the original equity incentive objectives were preserved.
- Consulted on a dispute regarding anti-dilution provisions and possible impact on the value of shares and warrants held by an earlier round investor. Analyses included sensitivity of valuation outcome based on alternative interpretations of the relevant provisions. Supported expert opinion on valuation impact on all shares from later rounds of financing.
- Consulted and performed analyses of the impact of a down round valuation on the existing shareholders and warrant holders in a VC-funded firm. Evaluated corporate governance process and communications between independent board committee and other board members in advance of the down round.
- Analyzed the relative market value of various series of investments on venture-funded firms using option valuation methodologies. Analyzed the structure and terms of financing agreements between a start-up and its early-stage investors.
- Consulted in a dispute involving the valuation of shares of a private company in an acquisition. Consulted on the dilutive effects of down rounds of venture-funded firms and the impact on common and earlier round investors.
- Consulted in a dispute involving the valuation of convertible notes in a venture-funded firm, and whether the note agreement allowed for a repayment of principal and accrued interest in lieu of conversion into common stock.
- Assessed the value of founder stock options in a fast-growing privately funded firm and the sensitivity to valuation assumptions as a stand-alone entity versus an acquisition. Evaluated the economic position of a partner in a venture capital firm in a divorce dispute.

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- Consulted in a dispute involving the economic value of compensation for services to a non-employee third-party consultant. Performed qualitative and data benchmarking analyses on alternative approaches for compensating non-employee contributors.

Digital Assets

- Provided expert reports and testimony on the fair value of a venture-funded CFTC-regulated exchange with a trading platform that offered cryptocurrency derivatives and traditional financial derivatives. Explained the economic characteristics of futures contracts and their typical use cases and regulatory considerations. Analyzed reliability of management projections and assessed fair value under the income and market approaches.
- Analyzed the relevant agreements and flow of collateral between a digital asset borrower and digital asset lender during a period of stress in cryptocurrency markets. Consulted on the actions taken by lender, including the seizing and liquidation of collateral, and analyzed whether such actions deviated from industry custom and practice and the ordinary course of business.
- Consulted during negotiations between a cryptocurrency exchange and the founding team of a cryptocurrency token/project. The analyses focused on whether certain milestones were met that would trigger payoff of various warrant agreements between the parties. Conducted market research on practices surrounding listing of new tokens, functionalities and features of decentralized exchanges (DEXs), and liquid staking protocols and current market standards.
- Provided expert opinion in a dispute surrounding the alleged stake of a co-founder in a digital assets marketplace. Analyzed relative pricing of certain NFTs' digital tokens against related fungible tokens.
- Consulted on a price impact analysis involving the disposition plan of a co-founder's stake in a major cryptocurrency. Analyzed transaction data on third-party digital asset exchanges, including price, volume, and price variation across exchanges.
- Consulted on and analyzed the correlation between the information released from an issuer of a digital token and the price of the token. Supported economic analysis of the statistical significance of observed correlation over time.
- Analyzed and prepared consulting reports on the uses and market structure of a major stablecoin. Performed economic analyses to explore the factors that contribute to volatility in major cryptocurrencies and to discriminate between correlation and causation.
- Consulted on the product structure, economic characteristics, and trading activity of cryptocurrency derivatives on a cryptocurrency exchange. Analyzed compliance requirements and disclosures in the context of the relevant regulatory framework.

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- Advised on the design and use cases of a novel digital token to capture and reward social, business, and other network relationships of members.

Valuation

- Performed valuations of common and preferred equity, valuations of employee stock options, valuations of a hedge fund business, and valuations of privately held and public businesses in merger and acquisition disputes.
- Conducted many valuation analyses beyond those referenced above, including estimating the value of callable municipal bonds and of convertible bonds, analyzing the volume price relationships on options on futures contracts, and estimating the value of lower tranches in RMBS and other asset-backed securities.
- Analyzed and provided an opinion on the value of recurring royalties on a portfolio of media assets (movies and music) and the contractual claims accruing to performing actors and musicians.

Structured Finance

- Analyzed methodologies and evaluated data sources used in the valuation of residential mortgage-backed securities (RMBS) and commercial MBS (CMBS). Developed a systematic methodology to value a portfolio of illiquid asset-backed securities (ABS).
- Assessed and critiqued cash flow and waterfall models used as valuation tools of RMBS and CDOs. Analyzed prepayment assumptions and the impact of borrower options to refinance with declining rates.
- Consulted on the impact of trades by the collateral manager on expected cash flows on senior and junior tranches of a CDO structure. Evaluated the impact of assumptions about prepayments, defaults, and recoveries to pools of underlying assets. Performed sensitivity analyses on resulting cash flows.
- Evaluated historical and projected collateral performance across a range of ABS, including less-common collateral of healthcare and student loan receivables. Assessed contemporaneous valuation measures, modifications, and other servicer actions, as well as the quality and transparency of reporting by trustees. Estimated the investors' economic losses.
- Analyzed and supported expert work on industry practices and business motivation of cross-border structured finance deals between financial institutions. Investigated banking spreads that considered the tax treatment of structures.
- Reviewed and analyzed default and recovery assumptions and credit-risk models used by rating agencies in rating structured finance securities like CDOs and RMBSs. Simulated

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complex options and structured finance products to validate pricing and assess the profitability of trading strategies.

Financial Institutions

- Consulted on multiple financial institutions' engagements on private litigation and regulatory matters involving major investment and commercial banks, asset management firms, hedge funds, and venture capital funds, among others.
- Provided an economic analysis of the factors that affected the performance of a leveraged municipal portfolio's trading strategies. Consulted on class certification issues related to the suitability of municipal investments.
- Issued analysis that explained the structure of credit default swaps and the application of ISDA provisions upon early contract termination. Analyzed fixed-income and derivative trading desk portfolio positions and performed sensitivity analyses assuming different scenarios of benchmark LIBOR rates.

Securities Litigation

- Performed and managed consulting and expert work in securities litigation. Analyzed the reaction of securities prices to information disclosures in Rule 10b-5 matters, and in matters involving alleged violations of Sections 11 and 12 of the Securities Act of 1933.
- Consulted on the impact of corrective disclosures related to fraudulent omissions on the value of privately placed 144A notes. Quantified the monetary impact of such disclosures to investors and analyzed the market microstructure of this market using TRACE data.
- Addressed a wide range of issues relevant to securities litigation – including class certification, market efficiency, loss causation, liability, materiality, and damages. Designed and conducted event studies to measure the impact of market and industry or systemic effects on the returns of equity, fixed income, and other securities.
- Estimated class-wide damages and probed the allocation of damages to various claimholders. Studied timing and impact of short selling on security prices. When available, relied on trading patterns and trading records, including FIFO/LIFO assumptions, to quantify damages.

Asset Management

- Analyzed the impact of securities related to option-trading strategies and on volatility strategies on investor portfolios. Consulted on assessment and quantification of damages including during periods of market stress and illiquid conditions. Examined the impact of these strategies in the context of the overall asset allocation and under suitability standards.
- Analyzed general and client-specific suitability in the context of expert analysis. Assessed information provided and disclosures by financial advisors and relevant communication with

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advisory clients. Examined the performance of investments selected by advisors on behalf of their advisory clients against the performance of benchmarks of investments with similar investment objectives. Evaluated potential harm to investors from alleged advisor misconduct.

- Evaluated the impact of rate volatility on the profitability of municipal arbitrage trading and hedging strategies of hedge funds and the possible effect on investors. Assessed damages to mutual fund investors from exposure to CDOs.
- Assisted clients with estimating the impact of implementation errors in trading strategies of active equity portfolios and on the performance shortfall realized in customer accounts. Performed economic analyses related to the foreseeability of price changes in municipal and other fixed-income securities. Also addressed suitability issues.

A.3 PUBLICATIONS

- “Economic Issues to Watch in the Libor Transition,” with Ryan Leary and Musa Isani, Law360 (June 2023)
- “From USD LIBOR to SOFR,” with Ryan Leary and Musa Isani, Brattle whitepaper (April 2023)
- “Crisis May Trigger Collateralized Loan Obligation Litigation,” with John Anthony, Law360 (July 2020)
- “Bitcoin Futures Markets: A Year Later” with Marek Zapletal, Mondaq (March 2019)
- “Recent Outperformance of Passive Investment Funds Has Provided a Rationale for Some ERISA Retirement Investors to Cry Foul. Is there a Case for Active Management?” with Christopher Laursen and John Anthony, Securities Regulation Daily (February 2019)
- “ICOs: What Are They And What Does The Future Hold?” with Sujay Dave, Securities Regulation Daily (June 2018)
- “Expert Analysis: Target Date Funds: Economic, Regulatory and Legal Trends,” with Branko Jovanovic and Christopher Laursen, Law360 (December 2017)
- Target Date Funds: Economic, Regulatory, and Legal Trends, with Branko Jovanovic and Christopher Laursen (September 2017)
- “Securities Class Actions: Trading Models to Estimate Individual Investor Trading Activity and Aggregate Damages,” with Yingzhen Li and Torben Voetmann, The Brattle Group: Critical Thinking (May 2017)
- “Avoiding Pitfalls in the Litigation of Business Valuation,” with Gary Stahlberg and Bryan Plotts, chapter in PLI Course Handbook, Basics of Accounting for Lawyers 2013: What Every Practicing Lawyer Needs to Know, Chapter 7, pp. 181-213 (2013)

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A.4 PRESENTATIONS

- “Blockchain and Cryptocurrencies,” presented at the 5th International Conference in Global Business in the Digital Age and Post-Covid-19 sponsored by University of San Francisco (June 12, 2021)
- “Blockchain and Cryptocurrencies,” presented to General Motors (March 9, 2021)
- “Swap Contracts,” presented at DeCal Lecture Series, Berkeley, CA (April 26, 2018)
- “Big Data in the Context of Financial Services Litigation,” presented during DataLead 2014 conference, Berkeley, CA (October 2, 2014)

A.5 EDUCATION

- Stanford University (2006) MSc, Financial Mathematics
- UC Berkeley Haas School of Business (2005) Master of Financial Engineering
- St. John’s University (1999) MBA, International Finance
- Aristotelian University of Thessaloniki (1993) BS, Pharmaceutical Sciences

A.6 PROFESSIONAL EXPERIENCE

- The Brattle Group (2014–Present) Principal
- UC Berkeley Haas School of Business (2013–Present) Lecturer: Undergraduate Program
- Finance Scholars Group (2012–2014) Principal
- Cornerstone Research (2006–2012) Senior Manager
- Credit Suisse First Boston, CSFBdirect (2000–2001) Manager
- DLJdirect, iNautix Technologies (2000) Program Manager
- Bear Stearns Asset Management (1999–2000) Analyst
- I.E. Gkatzimas & Partners (1996–1997) Manager
- Hellenic Armed Forces (1994–1996) Second Lieutenant (Officer-in-reserve)

A.7 PROFESSIONAL AFFILIATIONS

- American Bar Association (non-lawyer member)
- Bar Association of San Francisco
- Chartered Financial Analyst

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- CFA Society of San Francisco

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APPENDIX B: LIST OF DOCUMENTS RELIED UPON**Case Documents**

- United States Bankruptcy Court for the District of Delaware, Declaration of Sabrina T. Howell in Support of the Motion of Debtors to Estimate Claims Based on Digital Assets, *In re: FTX Trading Ltd., et al.*, Debtors, Chapter 11, Case No. 22-11068 (JTD), (Jointly Administered)
- FTX_DA_EST_000000068.XLSX

Articles

- Albert S. Kyle and Anna A. Obizhaeva, 2016, “Market microstructure invariance: empirical hypotheses”, *Econometrica* 84(4), pp. 1345 – 1404, p. 140
- Patrick Augustin, Alexey Rubtsov, and Donghwa Shin, 2023, “The impact of derivatives on spot markets: Evidence from the introduction of bitcoin futures contracts.” *Management Science*, 69(11), 6752-6776.

Publicly Available Websites

- “Kraken Futures eligibility,” Kraken Support, accessed February 16, 2024 at <https://support.kraken.com/hc/en-us/articles/360023786632-Kraken-Futures-eligibility>
- “Perpetual futures introduction,” Coinbase Help, accessed February 16, 2024 at <https://help.coinbase.com/en/coinbase/trading-and-funding/derivatives/pf-intro>
- Binance Twitter feed, November 9, 2022. Available at: <https://twitter.com/binance/status/1590449161069268992?s=20>
- Binance, “Introduction to Binance Futures Funding Rates”, November 08, 2019, accessed February 15 2024 at <https://www.binance.com/en/support/faq/introduction-to-binance-futures-funding-rates-360033525031>
- Candice Choi, “Crypto Crisis: A Timeline of Key Events,” *The Wall Street Journal*, June 6, 2023, accessed February 13, 2024 at <https://www.wsj.com/articles/crypto-crisis-a-timeline-of-key-events-11675519887>
- Ian Allison, “Divisions in Sam Bankman-Fried’s Crypto Empire Blur on His Trading Titan Alameda’s Balance Sheet,” *CoinDesk*, November 2, 2022, accessed February 15, 2024 at <https://www.coindesk.com/business/2022/11/02/divisions-in-sam-bankman-frieds-crypto-empire-blur-on-his-trading-titan-alamedas-balance-sheet/>

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- James Cirrone and Katherine Ross, “FTX began to unravel one year ago today: A timeline,” *Blockworks*, November 6, 2023, accessed February 13, 2024 at <https://blockworks.co/news/ftx-meltdown-timeline>
- Joel Khalili, “The Race to Save Sam Bankman-Fried’s Other Crypto Exchange,” *Wired*, November 22, 2022, accessed February 16, 2024 at <https://www.wired.com/story/ftx-serum-crypto-exchange/>
- Project Serum Overview. Available at: <https://docs.projectserum.com/introduction/overview>

Data Sources

- CoinAPI
- srm_volumes_derivative.csv from TMSI
- srm_volumes_spot.csv from TMSI